

WHAT IS CLAIMED IS:

- 1           1.     A body fluid sampling device comprising:  
2           a single cartridge;  
3           a penetrating member coupled to said single cartridge; and  
4           an analyte detecting members.
- 1           2.     A method of controlling fluid flow, the method comprising:  
2           (a)     providing a cartridge configured to slidably hold a plurality of  
3     penetrating members and to have a plurality of analyte detecting members; and  
4           (b)     using surface texturing on the cartridge to form texturing to direct  
5     fluid into a desired area on the cartridge.
- 1           3.     The method of claim 2 wherein said texturing is formed  
2     chemically.
- 1           4.     The method of claim 2 wherein the surface texturing guides the  
2     fluid to one of said analyte detecting members.
- 1           5.     A body fluid sampling device comprising:  
2           a single cartridge;  
3           a plurality of penetrating members coupled to said single cartridge and  
4     operatively couplable to a penetrating member driver, said penetrating members movable  
5     to extend radially outward from the cartridge to penetrate tissue;  
6           a plurality of analyte detecting members coupled to said single cartridge,  
7     wherein at least one of said analyte detecting members positioned on the cartridge to  
8     receive body fluid from a wound in the tissue created by the penetrating member when  
9     the cartridge is in an operative position; and  
10          a texture structure on said cartridge positioned to guide fluid generated by  
11     said tissue towards one of the analyte detecting members.
- 1           6.     A body fluid sampling device comprising:  
2           a single cartridge;

3 a plurality of penetrating members coupled to said single cartridge and  
4 operatively couplable to the penetrating member driver, said penetrating members  
5 movable to extend radially outward from the cartridge to penetrate tissue;

6 a plurality of analyte detecting members coupled to said single cartridge,  
7 wherein at least one of said analyte detecting members positioned on the cartridge to  
8 receive body fluid from a wound in the tissue created by the penetrating member when  
9 the cartridge is in an operative position; and

10 a plurality of mesh structures positioned to draw fluid generated by said  
11 tissue towards one of the analyte detecting members.

1 7. The device of claim 6 further comprising a ring around the  
2 cartridge wherein said analyte detecting members are mounted on said ring, along with  
3 said mesh.

1 8. The device of claim 6 further comprising a ring around the  
2 cartridge wherein said analyte detecting members are coupled to said cartridge through  
3 said ring.

1 9. The device of claim 6 further comprising a plurality of electrodes  
2 coupled to said analyte detecting member.

1 10. The device of claim 6 wherein the mesh is a gradient mesh.

1 11. A body fluid sampling device comprising:  
2 a support structure;  
3 a sensory material on a first side of said support structure;  
4 a conductor material coupled to the sensory material; and  
5 a commutator positioned to engage said conductor material to obtain  
6 analyte measurements.

1 12. The device of claim 11 further comprising a radial cartridge, said  
2 support structure coupled to said radial cartridge.

1 13. The device of claim 11 further comprising a plurality of electrodes  
2 each having said sensory material.

1 14. A penetrating member actuator comprising:

2 a support structure;  
3 a first electrode;  
4 a second electrode;  
5 an elastomeric material between said electrodes, wherein said material  
6 elongates upon activation of the electrodes, causing a penetrating member to move.

1 15. The device of claim 14 further comprising a radial cartridge, said  
2 material having a gripper positioned to engage penetrating members on said radial  
3 cartridge.

1 16. The device of claim 14 further comprising a coupler in contact with  
2 the material for coupling the penetrating member to the material.

1 17. A method for designing an analyte detecting member, the method  
2 comprising:

- 3 (a) mathematically replicating the significant physical and chemical  
4 processes taking place in the analyte detecting member and sample; and  
5 (b) dividing assay time into small time steps and the analyte detecting  
6 member into small control volumes, wherein during each time step (and in each control  
7 volume), the model simultaneously solves a specie conservation equation for each  
8 important constituent: oxygen, glucose, glucose oxidase, catalase, and hydrogen peroxide.

1 18. The method of claim 17 wherein each conservation equation  
2 includes an accumulation term, a diffusion term, and a production/destruction term  
3 wherein the latter relies on a production rate calculated either as a Michaelis-Menton  
4 reaction (catalase) or Ping-Pong Bi-Bi reaction (glucose oxidase).

1 19. The method of claim 17 wherein tracking the diffusion of each  
2 important chemical component of the emulsion and sample, the chemical reactions  
3 between them, and the resulting signal from oxygen depletion.

1 20. The method of claim 17 wherein treating the emulsion as a  
2 continuum with properties based on volume-fraction averages of the properties of the  
3 hydrophobic and hydrophilic phases.

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